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discussion papers

FS IV 02 – 08

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May 2002

ISSN Nr. 0722 - 6748

**Forschungsschwerpunkt
Markt und politische Ökonomie**

**Research Area
Markets and Political Economy**

Zitierweise/Citation:

Johan Lagerlöf and Paul Heidhues, **On the Desirability of an Efficiency Defense in Merger Control**, Discussion Paper FS IV 02-08, Wissenschaftszentrum Berlin, 2002.

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ABSTRACT

On the Desirability of an Efficiency Defense in Merger Control*

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We develop a model in which two firms that have proposed to merge are privately informed about merger-specific efficiencies. This enables the firms to influence the merger control procedure by strategically revealing their information to an antitrust authority. Although the information improves upon the quality of the authority's decision, the influence activities may be detrimental to welfare if information processing/gathering is excessively costly. Whether this is the case depends on the merger control institution and, in particular, whether it involves an efficiency defense. We derive the optimal institution and provide conditions under which an efficiency defense is desirable. We also discuss the implications for antitrust policy and outline a three-step procedure that take the influence activities into consideration.

Keywords: lobbying, rent seeking, asymmetric information, disclosure, efficiency gains, antitrust

JEL Classification: D72, D82, K21, L40

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* This paper was produced as part of a CEPR research network funded by the European Commission under the TMR program (contract #ERBFMRXCT980203). For helpful comments we thank Thorsten Bayindir-Upmann, Ramón Faulí-Oller, Fabienne Ilzkovitz, Rainer Nitsche, Michael Raith, Christian Wey, as well as conference and seminar participants at ESEM 2001 (Lausanne, Switzerland), EARIE 2001 (Dublin), the Verein für Socialpolitik Meetings 2001 (Magdeburg, Germany), Leuven (Belgium), ECARES (Brussels), the 1st Barcelona Workshop on Economic Design 2001, the 10th WZB Conference on IO 2001 (Berlin), and the TMR workshop in Lisbon 2001. Part of Lagerlöf's research was carried out while he visited ECARES at the Free University of Brussels, whose hospitality he gratefully acknowledges.

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ZUSAMMENFASSUNG

Wann ist eine Effizienzverteidigung in der Fusionskontrolle wünschenswert?

Eine Effizienzverteidigung in der Fusionskontrolle besagt, dass wettbewerbsbeschränkende Fusionen dann erlaubt werden, wenn hinreichend große Synergieeffekte zu erwarten sind. Mögliche Synergieeffekte einer Fusion sind jedoch hauptsächlich den fusionierenden Unternehmen bekannt. Eine Effizienzverteidigung ermöglicht es den fusionierenden Unternehmen, die Entscheidung der Wettbewerbsbehörde zu beeinflussen, indem sie der Wettbewerbsbehörde ihre Informationen strategisch weitergeben (oder zurückhalten). Die Autoren untersuchen, ob und wann eine Effizienzverteidigung aus gesellschaftlicher Sicht wünschenswert ist.

Hierzu entwickeln sie ein Model, in dem Unternehmen, die fusionieren möchten, private Informationen über die Synergieeffekte der Fusion besitzen. Die Unternehmen können die Entscheidung der Wettbewerbsbehörde beeinflussen, indem sie ihre Informationen strategisch an die Wettbewerbsbehörde weiterleiten. Obwohl die Informationen über Synergien die Entscheidung der Wettbewerbsbehörde verbessern, kann die Einflussnahme der Firmen die Wohlfahrt verringern, falls die Firmen zu viel in das Sammeln und Verarbeiten dieser Informationen investieren. Ob dies der Fall ist, hängt von der Ausgestaltung der Fusionskontrolle ab und insbesondere davon, ob die Fusionskontrolle eine Effizienzverteidigung zulässt. In dem theoretischen Model wird die optimale Fusionskontrollinstitution hergeleitet und Bedingungen herausgearbeitet unter denen eine Effizienzverteidigung wünschenswert ist. Die Autoren erörtern die Implikationen des Modells für die Fusionspolitik und entwickeln ein Drei-Stufen-Verfahren für Fusionsentscheidungen, welches die Einflussaktivitäten der Unternehmen berücksichtigt.

"[A] policy of approving anticompetitive mergers for efficiency reasons is likely to promote a dissipation of resources into rent seeking." Franklin M. Fisher (1987, p. 39)

1 Introduction

The appropriate regulation of mergers is an important policy issue in the US as well as in Europe, and the question whether efficiency gains (either proven or only claimed) should constitute a reason not to challenge an otherwise anticompetitive merger is much debated.[1] Williamson (1968) was the first to stress that the decision whether to permit a merger potentially involves a welfare tradeoff: whereas permitting the merger is likely to increase the merged unit's market power, as doing this reduces the number of rivals competing in the market, it may also allow the newly created firm to realize efficiency gains. One strand of the theoretical literature on mergers has investigated this tradeoff in various oligopoly models; see, for example, Williamson (1968), Deneckere and Davidson (1985), Farrell and Shapiro (1990), and Spector (2001).

While these contributions can inform an antitrust authority's decision whether to permit a proposed merger and, for example, provide reasons to be very sceptical, they do not explain why an antitrust authority *as a matter of principle* should rule out the possibility that an anticompetitive merger may be permitted for efficiency reasons: rules and guidelines that do exactly this (like the previous ones used in the US and the current ones in the EU) cannot be justified by the literature cited above. However, one conceivable benefit with making an irreversible commitment not to permit mergers for efficiency reasons is that this may discourage rent seeking or other forms of influence activities. This point has indeed often been made in the literature; see, for example, the above

[1] Currently, the American policy allows for an explicit efficiency defense whereas the European does not. Until fairly recently, however, the US policy, as expressed by the Horizontal Merger Guidelines issued by the Department of Justice and the Federal Trade Commission, placed much less weight on the efficiency criterion; for a discussion and evaluation of these changes of the Guidelines, in particular with respect to the treatment of efficiencies, see for example Farrell and Shapiro (2001) and several of the contributions in the Spring 1999 issue of the George Mason Law Review. On the other side of the Atlantic, the European Commission is currently considering to move toward taking possible efficiencies into account when assessing proposed mergers; for recent discussions, see Röller, Stennek, and Verboven (2000), Ilzkovitz and Meiklejohn (2001), and European Commission (2001). One reason why the European Commission is currently considering this step is that the increased frequency of cross-border mergers has raised the question whether American and European rules should be standardized.

quotation by Fisher.[2] Yet it is not clear whether all kinds of influence activities should count as a social cost of allowing for an efficiency defense. For if the activities take the form of outright monetary bribes, then they merely represent a transfer of wealth between different economic agents. Similarly, one often-mentioned reason why allowing for an efficiency defense may make the merger control procedure easier to influence is that the merging firms (hereafter called the *insiders*) typically have superior access to information about any efficiencies;[3] hence, by strategically transmitting such information to the antitrust authority, the insiders may be able to achieve a favorable decision. The welfare effects of such influence activities could be either positive or negative, depending on whether the cost of gathering, processing, and transmitting the information is offset by its social benefits.[4]

Thus, in order to better understand under what circumstances influence activities indeed may serve as a reason not to allow for an efficiency defense, it is important to model the reason why they may be influential and then, in an equilibrium analysis, investigate the welfare effects of different merger control institutions, with and without an efficiency defense. To the best of our knowledge, there is no attempt in the literature to do this. The present paper tries to fill this gap. Although the model we develop is relatively simple, it captures three important aspects of a merger control procedure: Williamson's tradeoff between increased market power and possible efficiency gains, the insiders' having superior access to information about any efficiencies, and these firms' vested interest in having the merger permitted.

In particular, we model the merger control procedure as an interaction between two economic agents: the insiders (acting as one unit) and society. The

[2] The argument can also be found in Neven et al. (1993, p. 213, n. 41) and in Röller et al. (2000, p. 121)

[3] The Horizontal Merger Guidelines (US Department of Justice and US Federal Trade Commission, 1997, Section 4) state explicitly that "[...] much of the information relating to efficiencies is uniquely in the possession of the merging firms." Yao and Dahdouh (1993) discuss the problem of informational asymmetries in merger control at length and argue that asymmetries in the access to information are particularly important for efficiencies.

[4] An early paper that explicitly interprets rent-seeking expenditures as costs of information gathering is Tullock (1975). Later contributions that have provided informational foundations to the rent-seeking theory, by showing that there may be overinvestment in information acqusition from a social welfare point of view, include Shavell (1994) and Lagerlöf (1997). More generally, lobbying as a form of strategic information transmission has been modeled in, for example, Austen-Smith and Wright (1992); for a recent survey, see Grossman and Helpman (2001).

efficiency gains due to the merger may be "low" or "high." Whereas the insiders want to merge regardless of the size of the efficiencies, society only wants the merger to take place if they are high. Initially, only the insiders know whether the efficiencies are high or low. This information, however, is soft (i.e., non-verifiable), which means that in order to be able to credibly transmit it to society, the insiders must first invest resources in evidence production. If they do this and if they are successful, they find hard (i.e., verifiable) information about the size of the efficiency gains, which they (if this is in their interest) can disclose to society.[5] The role of society is to choose a merger control institution, by which we mean a rule whether to permit the proposed merger conditional on whether the insiders have submitted a report and whether this report showed that the efficiencies are high or low. We assume that society commits to such a rule at an ex ante stage. A merger control institution that "allows for an efficiency defense" is understood as a rule where the fact that the insiders have provided hard information about the size of the efficiencies (instead of not having done this) affects the probability that the merger is permitted.

In an equilibrium of this model, the insiders will never invest in evidence production when having soft information that the efficiencies are low. When they have soft information that the efficiencies are high, whether and to what extent they invest depend on what institution society has chosen. An institution that does not allow for an efficiency defense will not induce any evidence production at all. Two examples of such institutions that are important in our analysis are what we call the *laissez-faire regime* (LF) and the *strict regime* (SR): under LF, a merger is always permitted while under SR it never is.[6] By committing to an institution that to some extent indeed allows for an efficiency defense, society can induce a positive amount of evidence production. One such institution is

[5] Hence, we assume that the insiders incur costs because they must *process* their information (i.e., transform it from soft to hard) before being able to communicate it. We would get almost the same results if we instead assumed that the insiders' costs concerned the *acquisition* of information; see our discussion in the concluding section. One may argue about which assumption is the most plausible; perhaps it is something in between those two polar cases. In any case, what we want to capture with our assumption is the real-world phenomenon that firms that want to merge typically, with the aim of convincing the antitrust authorities that the merger should be permitted, hire lawyers and economists as consultants and make extensive use of their own personnel and other resources to prepare their case.

[6] The important feature of these institutions is that the decision whether to permit the merger is not made contingent on the insiders' reports about *efficiencies*. The decision could, however, very well be contingent on other circumstances, as long as these are publicly known. See our discussion in Section 5.

the one where a merger is *not* permitted if society receives a report saying that the efficiencies are low or if it does not receive any report at all, and the merger is permitted with a probability γ if society receives a report saying that the efficiencies are high. Here, the larger is γ the more the insiders will invest. In the extreme, when the probability γ equals unity, we obtain the *hard evidence regime* (HE): a merger is permitted if and only if society receives a report saying that the efficiencies are high.

Hence, in our model, a possible cost of allowing for an efficiency defense is that this encourages the insiders to spend resources in order to influence the decision whether to allow the merger. The resource costs enter the social welfare function and may thus, in principle, be wasted. On the other hand, the information that the insiders report might be useful for society, in which case there also are benefits with an efficiency defense. Society thus faces a tradeoff. It turns out that even though society has an opportunity to fine tune the insiders' incentives for evidence production by choosing an institution that gives rise to a positive amount of evidence production but still less than under HE, this is never optimal. That is, the institution that maximizes expected social welfare is either SR, LF, or HE. One reason for this result is that society can only choose the insiders' amount of evidence production indirectly, through its choice of the merger control institution. Thus, society's ability to choose investment incentives is limited by the insiders' optimal response. In addition, institutions whose outcomes differ from the outcomes of SR, LF, and HE require society to commit to an ex post merger decision that uses the available information suboptimally.

Finding the socially optimal institution thus amounts to comparing LF, SR, and HE, of which only HE involves an efficiency defense. We show that, depending on the parameters of our model, any one of these three institutions can be optimal. By inspecting the conditions needed for a particular institution to be the best one, we arrive at some non-trivial and sometimes rather subtle conclusions about the desirability of an efficiency defense and the optimal design of a merger control procedure. First, as the arguments above suggest, an efficiency defense is indeed sometimes desirable. If so, however, the burden of proof as to the existence of large efficiencies should be placed fully on the merging firms. Second, an efficiency defense is more likely to be optimal (from a total surplus point of view) when "high" efficiencies are so high that they would give rise to a lower market price. This is because then the insiders' incentives to invest are such that society should encourage evidence production as much as it can. Third, there is an important asymmetry between situations with a low respectively high prior probability that a merger would increase total surplus: when the prior is relatively low, the problem of the insiders' dissembling can be dealt with very easily and at no real cost, whereas this is not true for the case when the prior is relatively high. As a consequence, an efficiency defense is more desirable when the merger is unlikely to be welfare enhancing.

Although this paper is, to the best of our knowledge, the first one to investigate the desirability of an efficiency defense using an equilibrium analysis, there are some other papers that also study institutional design in the context of merger control. Besanko and Spulber (1993) and Neven and Röller (2001), for example, study the relative merits of a welfare standard and a consumer standard. Similarly, Lewis and Poitevin (1997) investigate the desirability of mandatory disclosure rules in regulatory proceedings. Laffont and Tirole (1993, ch. 15) develop a model of regulatory capture and institutional design, although not in the context of merger control. Our paper is also related to a literature that models evidence production in trials or regulatory proceedings; see, for example, Sanchirico (2001) and Legros and Newman (1999). Their way of modeling evidence production, however, is different from ours. Similarly, information acquisition and institutional design has also been studied by, for example, Aghion and Tirole (1997) and Dewatripont and Tirole (1999).[7]

The remainder of the paper is organized as follows. Next, in Section 2, we present the model. In Section 3 we begin the analysis and show that the optimal merger control institution is either LF, SR, or HE. Then, in Section 4, we compare these three institutions and find the optimal one. In Section 5 we discuss the implications of our results for antitrust policy. In particular we sketch a three-step merger control procedure that takes the influence activities into consideration. Section 6 concludes by briefly discussing some possible extensions and variations of our model.

[7] Other related papers include Corchón and Faulí-Oller (2000), Daughety and Reinganum (2000), Froeb and Kobayashi (2001), and Shin (1998).

2 A Model of Merger Control and Influence Activities

Consider the following simple model of a merger control process. There are two economic agents: on the one hand society and on the other two firms that have proposed to merge (acting as one unit). The two firms, which are hereafter called the *insiders*, should be thought of as producing and selling a good on an oligopolistic market, although the market interaction will not be explicitly modeled here. The other firms on that market (the *outsiders*), as well as the consumers, are passive in that they do not attempt to influence the merger control process.[8]

The efficiency of the new firm that is created if the merger takes place, denoted e, is either "low" ($e = e_L$) or "high" ($e = e_H$). Initially, e is private information to the insiders: society' places the prior probability p on the event that the post-merger efficiency is high, where $p \in (0, 1)$. Although the insiders do know the true post-merger efficiency already from the outset, the information they have is assumed to be soft (i.e., non-verifiable). This means that, given the preferences that we will specify shortly, the insiders will not be able to credibly transmit their information to society—for that they will first have to invest resources in evidence production (more on this later).

We assume that regardless of whether the post-merger efficiency is low or high, it is profitable for the insiders to merge; that is,

$$\pi_H > \pi_L > \pi_N, \tag{1}$$

where π_H (respectively, π_L) is the insiders' profit if the merger is permitted and the post-merger efficiency turns out to be high (respectively, low), and π_N is the insiders' (joint) profit if the merger is banned. Moreover, permitting the merger increases social welfare if and only if the post-merger efficiency turns out to be high; that is,

$$W_H > W_N > W_L, \tag{2}$$

where W_H (respectively, W_L) is the unweighted sum of consumer surplus and industry profits if the merger is permitted and the post-merger efficiency turns

[8] In the concluding section we briefly discuss how our analysis would be affected if also the outsiders or a consumer group were taking part in the influence activities.

out to be high (respectively, low), and W_N is the unweighted sum of consumer surplus and industry profits if the merger is banned.

Let us for notational ease write $\Delta\pi_i \equiv \pi_i - \pi_N$ and $\Delta W_i \equiv W_i - W_N$ (for $i = L, H$). In terms of this notation, (1) and (2) amount to saying that $\Delta\pi_H$, $\Delta\pi_L$, and ΔW_H are all positive, whereas ΔW_L is negative. Borrowing terminology from Farrell and Shapiro (1990), we will refer to the case where $\Delta W_H < \Delta\pi_H$ as a situation with *negative externalities*, and the case where $\Delta W_H > \Delta\pi_H$ as a situation with *positive externalities*. All our analysis will cover both these cases. Yet, the distinction between positive and negative externalities will be helpful in understanding the results to be derived.

Although our proofs do not rely on it, we use the following assumption to interpret our results:

$$\Delta W_H > \Delta\pi_H \Leftrightarrow \Delta CS_H > 0,$$

where ΔCS_H is the gain in consumer surplus if the merger is permitted instead of banned, given that the post-merger efficiency is high. That is, the assumption states that if there are positive externalities, then also the consumers (not only society at large) gain from a high-efficiency merger. Notice that as long as consumer surplus is only affected by the merger through its effect on market price and as long as consumer surplus is decreasing in market price, a statement that ΔCS_H is positive is tantamount to saying that "high" efficiencies are so high that they induce a lower post-merger than pre-merger market price.

Figure 1 shows how, for different values of the efficiency parameter e, the gains and losses that accrue to the various parties if a merger takes place typically relate to each other.[9] The figure is derived from a homogenous-good Cournot model with at least three symmetric firms prior to the merger, where demand and cost functions are linear, and where the efficiency parameter e is subtracted from the marginal cost of the insiders. Although this is only a very simple example, we expect the qualitative features of the figure to hold true for a much larger family of oligopoly models.[10] From the figure we see that the

[9] Figure 1 is inspired by a similar figure in Neven and Röller (2000).

[10] For example, we have verified that all the qualitative features of Figure 1 also can be derived from a differentiated-goods Bertrand model with three symmetric firms prior to the merger, linear demand and cost functions, and the efficiency parameter e being subtracted from the marginal cost of the insiders. The only thing that changes in such a setting is that the insiders gain from the merger even if $e = 0$ (which is a well-known result).

insiders would make a loss themselves by merging if e did not exceed a threshold e°. Moreover, for the effect on welfare to be positive, e must exceed a threshold $e^{'}$, where $e^{'} > e^{\circ}$. Thus, in terms of these threshold values of e, (1) and (2) amount to assuming that $e_L \in \left(e^{\circ}, e^{'}\right)$ and $e_H > e^{'}$. We also see from the figure that the outsiders' gain in profits and the change in consumer surplus always have opposite signs, and these signs change at a threshold $e^{''}$, where $e^{''} > e^{'}$; this is the level of e above which market price becomes lower thanks to the merger. At the same threshold level of e, society's gain from having the merger starts to exceed the insiders' gain. Thus, there are negative externalities if $e_H \in \left(e^{'}, e''\right)$, whereas there are positive externalities if $e_H > e^{''}$.

The timing of events is as follows. (i) Society commits to a merger control institution, $z = (z_L, z_H, z_N) \in [0,1]^3$. We will shortly explain exactly what it means to choose a particular z. (ii) The insiders observe z and then "invest in evidence production"; that is, conditional on knowing that the true state is $i \in \{L, H\}$, they choose a probability $\tau_i \in [0,1]$, thereby incurring a cost $C(\tau_i)$. By picking a particular τ_i, the insiders will with that probability find hard (i.e., verifiable) information that the post-merger efficiency is e_i; with the complementary probability, $1-\tau_i$, the insiders do not find any hard information. (iii) If having found hard information, the insiders choose whether to "submit a report," that is, whether to disclose this information to society. If they do this, society also learns the true state (since the information is verifiable). (iv) Society decides whether to permit or ban the merger, following the previously chosen rule $z = (z_L, z_H, z_N)$. The component z_L (respectively, z_H) of this vector is a probability with which society permits the merger if the insiders have submitted a report saying that the post-merger efficiency is low (respectively, high), and z_N is a probability with which society permits the merger if the insiders have not submitted a report.

Hence, stage (iv) is simply an implementation of the rule that society has committed to at stage (i).[11] Notice that the set of instruments that society has

[11] There may of course be a credibility problem associated with choosing some particular z, perhaps especially for "mixed" z's. One way to implement the desired z-institution in practice may be to delegate the job to an antitrust official who has the right private preferences; cf. the literature on strategic delegation (to an independent central banker, for example). A mixed z-institution could also correspond to a set of guidelines that to some extent are to open to interpretation and which therefore make it difficult to predict perfectly the decision whether to challenge the merger. Yet another reason why we are not too worried about the credibility

access to when it chooses an institution does not include monetary transfers between society and the insiders.[12] Otherwise, however, society has a great deal of freedom in its choice of an institution. For at the stage where society implements the rule z it will either know the true state (L or H) or it will not have received a report (N), and we assume that society can commit to any probability of allowing the merger conditional on any one these three events.

In terms of these merger control institutions, what does it mean to say that society "allows for an efficiency defense"? We interpret this as a situation where a report submitted by the insiders affects the probability with which the merger is permitted. That is, we say that society allows for an efficiency defense if either $z_L \neq z_N$ or $z_H \neq z_N$. Within the set of merger control institutions that society can choose among there are three ones that will be of particular interest to us. The first is the institution where a merger is always permitted, $z = (1, 1, 1)$; we call this the *laissez-faire regime* (LF). The second one is the institution where a merger is never permitted, $z = (0, 0, 0)$, which we call the *strict regime* (SR). The third institution of special interest is the one where a merger is permitted if and only if society receives a report from the insiders showing that the post-merger efficiency will be high, $z = (0, 1, 0)$; we dub this the *hard evidence regime* (HE). Clearly, neither LF nor SR involves an efficiency defense, whereas HE does.

As for the cost function for evidence production, C, we assume that this is twice continuously differentiable, increasing, and convex ($C' > 0$, $C'' > 0$), with $C(0) = 0$, $C'(0) = 0$, and $C'(1) > \Delta\pi_H$. Also, the cost elasticity is weakly increasing: $\eta'(\tau_i) \geq 0$ for all $\tau_i \in [0, 1]$, where $\eta(\tau_i) \equiv C'(\tau_i)\tau_i / C(\tau_i)$.[13]

The cost of evidence production incurred by the insiders enters with full weight in society's payoff. Hence, given an outcome j (for $j = L, H, N$) of the merger control procedure and given that the insiders have soft information that $e = e_i$ (for $i = L, H$), the insiders' payoff is $\pi_j - C(\tau_i)$ and society's payoff is $W_j - C(\tau_i)$. We also assume that the insiders as well as society are risk neutral

problem is that, as we will see later, it will never be optimal for society to choose the mixed z's anyway.

[12] We find this assumption reasonable in the context of merger control. For a paper that does allow for such transfers and which models the merger control procedure as an implementation problem, see Corchón and Faulí-Oller (2000).

[13] For some results in the end of the paper we will need the stronger assumption that the cost elasticity is constant. We will make this clear when we get there.

and thus maximize their expected payoffs given the information they have access to at the time of their decisions. Society's expected payoff ("expected welfare") is also the welfare standard that we employ for our normative theory.[14]

3 Influence Activities and Institutional Choice

We will solve the model using backward induction. Since the last stage is just a mechanical implementation of the rule society chooses at stage (i), we are left with three stages where actual decisions are made: the choice-of-institution stage (i), the evidence-production stage (ii), and the reporting stage (iii).

Recall that the insiders want the merger to be permitted regardless of whether the post-merger efficiency is low or high. Hence, at stage (iii), given that they have found hard information that $e = e_i$ the insiders will submit a report for sure if $z_i > z_N$; if $z_i = z_N$ they are indifferent between submitting and not submitting; and if $z_i < z_N$ they will not submit. Similarly, at stage (ii), given that they have soft information that $e = e_i$, the insiders will invest in evidence production (i.e., choose a $\tau_i > 0$) if and only if $z_i > z_N$. Clearly, however, society will never choose $z_L > z_N$. For if society knows that the post-merger efficiency is low, it is in its interest to ban the merger. (Moreover, setting $z_L > z_N$ would encourage costly evidence production under circumstances where this is not valuable for society.) As a result, if the institution z is optimally chosen, the insiders will set $\tau_L = 0$.

When having soft information that $e = e_H$, the insiders face the following problem:

$$\max_{\tau_H \in [0,1]} \left[\tau_H z_H + (1-\tau_H) z_N\right] \pi_H + \left[\tau_H (1 - z_H) + (1-\tau_H)(1-z_N)\right] \pi_N - C(\tau_H),$$

the solution of which, τ_H^*, equals zero if $z_H \leq z_N$ and is implicitly defined by

$$\Delta\pi_H (z_H - z_N) = C'(\tau_H^*) \tag{3}$$

otherwise. The left-hand side of this first-order condition is the insiders' marginal benefit from evidence production when knowing that $e = e_H$. The first factor of the marginal benefit, $\Delta\pi_H$, is the insiders' gain in profits from having the

[14] In the concluding section we will discuss the implications for our results of using a consumer standard instead.

merger permitted instead of banned given that $e = e_H$. The second factor, $(z_H - z_N)$, is the amount with which the probability of having the merger permitted increases if the insiders provide hard information that the post-merger efficiency indeed is high. The magnitude of this latter factor is determined by society's choice of institution. In particular, $(z_H - z_N)$ will take its largest possible value under the institution HE, since then $z_H = 1$ and $z_N = 0$. Hence, the insiders' incentives for evidence production when knowing that $e = e_H$ will be the strongest possible under HE.[15] Similarly, under LF and SR, the insiders will have no incentives at all to invest in evidence production ($\tau_H^* = 0$), since then $z_H = z_N$.

What is society's optimal choice of institution at stage (i)? To answer this question, let us first formulate expressions for expected welfare at stage (i) under LF, SR, and HE, which we denote by EW^{LF}, EW^{SR}, and EW^{HE}, respectively. Since under LF and SR the insiders will not invest in evidence production, we almost trivially have $EW^{LF} = pW_H + (1-p)\,W_L$ and $EW^{SR} = W_N$. Denoting the insiders' choice of τ_H under HE by τ_H^{HE}, we can write

$$\begin{aligned} EW^{HE} &= p\tau_H^{HE}W_H + (1 - p\tau_H^{HE})W_N - pC\left(\tau_H^{HE}\right) \\ &= p\tau_H^{HE}\Delta W_H + EW^{SR} - pC\left(\tau_H^{HE}\right). \end{aligned} \tag{4}$$

This equation highlights a basic tradeoff in society's choice of institution. By choosing an institution that encourages evidence production, like HE, instead of one that does not, like SR, society will sometimes be able to avoid the mistake of banning a welfare enhancing merger; this benefit with HE is captured by the term $p\tau_H^{HE}\Delta W_H$ in (4). Society also cares about the insiders' expected cost of evidence production, however, which is captured by the term $pC\left(\tau_H^{HE}\right)$. The comparison of HE and SR thus amounts to a comparison of $\tau_H^{HE}\Delta W_H$ and $C\left(\tau_H^{HE}\right)$, where τ_H^{HE} is implicitly defined by $\Delta\pi_H = C'\left(\tau_H^{HE}\right)$. Accordingly, which institution society should choose will depend on, among other things, how aligned society's and the insiders' interests are and on the properties of the cost function C.

In order to solve society's problem at stage (i) we will also need a more

[15] Notice the importance of the qualifier "when knowing that $e = e_H$." The institution that provides the strongest incentives for evidence production more generally is $z = (1, 1, 0)$, since this would make also τ_L^* as large as possible. Of course, however, choosing an institution that induces a $\tau_L^* > 0$ will, as we noted above, never be in society's interest.

general expression for expected welfare that holds for any relevant institution z. Recall that choosing $z_L > z_N$ will always be suboptimal for society. Moreover, setting $z_N > z_H$ yields the same outcome as setting $z_N = z_H$ (since for any $z_N \geq z_H$ the insiders will choose $\tau_H^* = 0$ and thus not be able to report when knowing that $e = e_H$). Hence, without excluding any (uniquely) optimal institution we can suppose that

$$z_L \leq z_N \leq z_H.$$

Under this assumption, we can write expected welfare at stage (i) as

$$\begin{aligned} EW &= p\left[\tau_H^* z_H + \left(1-\tau_H^*\right) z_N\right] W_H + (1-p) z_N W_L \\ &\quad + \left\{p\left[\tau_H^*\left(1-z_H\right) + \left(1-\tau_H^*\right)\left(1-z_N\right)\right] + (1-p)\left(1-z_N\right)\right\} W_N - pC\left(\tau_H^*\right) \\ &= p\tau_H^*\left(z_H - z_N\right)\Delta W_H + \left(1-z_N\right) EW^{SR} + z_N EW^{LF} - pC\left(\tau_H^*\right). \qquad (5) \end{aligned}$$

Now, rewriting the first-order condition that defines τ_H^* [see (3)] yields

$$\Delta\pi_H\left(z_H - z_N\right) = C'\left(\tau_H^*\right) = \frac{\eta\left(\tau_H^*\right)}{\tau_H^*} C\left(\tau_H^*\right) \Rightarrow \tau_H^*\left(z_H - z_N\right) = \frac{\eta\left(\tau_H^*\right)}{\Delta\pi_H} C\left(\tau_H^*\right). \qquad (6)$$

Substituting (6) in (5) and re-arranging, one has

$$EW = pC\left(\tau_H^*\right)\frac{\Delta W_H}{\Delta\pi_H}\left[\eta\left(\tau_H^*\right) - \frac{\Delta\pi_H}{\Delta W_H}\right] + \left(1-z_N\right) EW^{SR} + z_N EW^{LF}, \quad (7)$$

which implies that, for $\eta\left(\tau_H^*\right) < \frac{\Delta\pi_H}{\Delta W_H}$, society is strictly better off by choosing either LF or SR rather than an institution that induces investment in evidence production ($\tau_H^* > 0$). Moreover, if z is an optimal institution and if it gives rise to $\eta\left(\tau_H^*\right) = \frac{\Delta\pi_H}{\Delta W_H}$, then either LF or SR is (also) an optimal institution.

Next, suppose $\eta\left(\tau_H^*\right) > \frac{\Delta\pi_H}{\Delta W_H}$. We then obtain the following result.

Lemma 1. *Let $z_L \leq z_N \leq z_H$ and $\left(z_H - z_N\right) \in (0,1)$, and suppose that $\eta\left(\tau_H^*\right) > \frac{\Delta\pi_H}{\Delta W_H}$. Then $EW < \left(1-z_N\right) EW^{HE} + z_N EW^{LF}$.*

Proof. We can write

$$\begin{aligned} EW &= \left(z_H - z_N\right)\frac{p\tau_H^*\Delta W_H}{\eta\left(\tau_H^*\right)}\left[\eta\left(\tau_H^*\right) - \frac{\Delta\pi_H}{\Delta W_H}\right] + \left(1-z_N\right) EW^{SR} + z_N EW^{LF} \\ &< \left(1-z_N\right)\left\{\frac{p\tau_H^{HE}\Delta W_H}{\eta\left(\tau_H^{HE}\right)}\left[\eta\left(\tau_H^{HE}\right) - \frac{\Delta\pi_H}{\Delta W_H}\right] + EW^{SR}\right\} + z_N EW^{LF} \\ &= \left(1-z_N\right)\left[p\tau_H^{HE}\Delta W_H - \frac{p\tau_H^{HE}\Delta\pi_H}{\eta\left(\tau_H^{HE}\right)} + EW^{SR}\right] + z_N EW^{LF}. \end{aligned}$$

Here the first equality follows from (6) and (7); the inequality follows from $\tau_H^* < \tau_H^{HE}$, $z_H \leq 1$, and $\eta' \geq 0$; and the last equality is just a re-arrangement of terms. Making use of (4) and of (6) evaluated at $\tau_H^* = \tau_H^{HE}$, $z_N = 0$, and $z_H = 1$, we have the inequality in the lemma. □

The following proposition follows immediately from Lemma 1 and the preceding analysis.

Proposition 1. *No institution yields a higher expected welfare than the best one of SR, LF, and HE. Moreover, an institution where $z_L > z_N$ is never optimal, and an institution where $(z_H - z_N) \in (0, 1)$ is never optimal if $\eta(\tau_H^*) \neq \frac{\Delta\pi_H}{\Delta W_H}$.*

In other words, when society chooses an institution at stage (i), it will optimally select one that either induces no evidence production at all or one where the insiders' incentives for evidence production when knowing that $e = e_H$ are as strong as possible—in that sense society's problem always has a corner solution. What is the reason for this? One economic force that works in favor of a corner solution is that choosing a "mixed" z-institution involves throwing away costly but socially valuable information: by selecting such an institution society will sometimes learn that the true post-merger efficiency is high, but still it does not permit the merger with probability one. The institutions SR, LF and HE, in contrast, do not involve such waste. For under LF and SR there is no investment at all in evidence production. And under HE there is, but then the information is always made use of in the sense that society permits the merger with probability one when having learned that the efficiencies are high.

More generally, important for the corner-solution result is the fact that society cannot choose τ_L and τ_H directly, only indirectly through its choice of a z-institution. This means that society's optimal choice of an institution will depend on the insiders' response. As a consequence, society's objective function is not necessarily a quasi-concave function of the choice variables. Moreover, even when this objective function happens to be quasi-concave, society's limited set of instruments will make an institution where the insiders choose an interior τ_H undesirable.

4 The Optimal Merger Control Institution

It remains to answer the question how the three institutions LF, SR, and HE perform in terms of expected welfare relative to each other. In doing this we will impose a stronger assumption on the cost function C than before. Instead of just assuming that the cost elasticity is everywhere weakly increasing, we will from now on say that the cost elasticity is constant; that is, $C(\tau_i) = k\tau_i^{\eta}$ for $i = L, H$, where $k > 0$ and $\eta > 1$.[16] In order to make the comparisons it will be useful to distinguish between two parameter regimes: $p < \overline{p}$ ("Regime I"), and $p > \overline{p}$ ("Regime II"), where $\overline{p} \equiv (W_N - W_L) / (W_H - W_L)$.[17] Regime I should thus be thought of as a situation where society is relatively sceptic about the possibility of large efficiency gains, whereas in Regime II society is relatively optimistic about this possibility.

First, it is easy to see that SR dominates LF in Regime I, and vice versa in Regime II. Second, it turns out that SR strictly dominates HE if and only if $\eta < \Delta\pi_H/\Delta W_H$. To see this, simply plug $z_N = 0$, $\tau_H^* = \tau_H^{HE}$, and $\eta(\tau_H^*) = \eta$ into (7), which yields

$$EW^{HE} = pC\left(\tau_H^{HE}\right)\frac{\Delta W_H}{\Delta\pi_H}\left(\eta - \frac{\Delta\pi_H}{\Delta W_H}\right) + EW^{SR}.$$

It remains to compare HE and LF. From the above expression for EW^{HE} we see that $EW^{HE} > EW^{LF}$ is equivalent to

$$pC\left(\tau_H^{HE}\right)\frac{\Delta W_H}{\Delta\pi_H}\left(\eta - \frac{\Delta\pi_H}{\Delta W_H}\right) > EW^{LF} - EW^{SR} = p\Delta W_H + (1-p)\,\Delta W_L, \tag{8}$$

the right-hand side of which is negative in Regime I and positive in Regime II. First suppose we are in Regime I. Then, if $\eta \geq \Delta\pi_H/\Delta W_H$, we clearly have $EW^{HE} > EW^{LF}$. In case $\eta < \Delta\pi_H/\Delta W_H$ there exists a level of k, call it $\widehat{k}$, such that $EW^{HE} > EW^{LF}$ if and only if $k > \widehat{k}$. Using (8), the fact that

$$C\left(\tau_H^{HE}\right) = k^{\frac{-1}{\eta-1}}\left(\frac{\Delta\pi_H}{\eta}\right)^{\frac{\eta}{\eta-1}},$$

[16] This stronger assumption will actually only be needed for the comparison of LF and HE. The comparison of LF and SR will of course not depend on the cost function, and our comparison of SR and HE below easily extends to any arbitrary elasticity $\eta(\tau_i)$. Still, to simplify the exposition, we make the stronger assumption already from the the outset of this section.

[17] We will ignore the knife-edge case $p = \overline{p}$.

and carrying out some straightforward algebra, we obtain

$$\widehat{k} \equiv \left(\frac{\Delta\pi_H}{\eta}\right)^{\eta} \left(\frac{p\frac{\Delta W_H}{\Delta\pi_H}\left(\eta - \frac{\Delta\pi_H}{\Delta W_H}\right)}{p\Delta W_H + (1-p)\,\Delta W_L}\right)^{\eta-1}.$$

Next suppose we are in Regime II. Then for $\eta \leq \Delta\pi_H/\Delta W_H$ we always have $EW^{HE} < EW^{LF}$. In case $\eta > \Delta\pi_H/\Delta W_H$, we can, similarly to above, verify that $EW^{HE} > EW^{LF}$ if and only if $k < \widehat{k}$.

Let us summarize the above results in the following proposition.

Proposition 2. *Society ranks the three institutions LF, SR, and HE as follows:*

- *$SR \succ LF$ in Regime I, and $LF \succ SR$ in Regime II.*
- *$HE \succ SR$ if and only if $\eta > \Delta\pi_H/\Delta W_H$.*
- *In Regime I, $HE \succ LF$ if and only if either (i) $\eta \geq \Delta\pi_H/\Delta W_H$ or (ii) $\eta < \Delta\pi_H/\Delta W_H$ and $k > \widehat{k}$. In Regime II, $LF \succ HE$ if and only if either (i) $\eta \leq \Delta\pi_H/\Delta W_H$ or (ii) $\eta > \Delta\pi_H/\Delta W_H$ and $k > \widehat{k}$.*

By using Proposition 2 we can easily construct an overall ranking of the three institutions. Figure 2 indicates for what parameter values we obtain particular rankings; Panel A of the figure covers Regime I whereas Panel B covers Regime II. Each panel depicts a diagram with k on the vertical and η on the horizontal axis, and in each diagram the graphs of two functions are drawn: $\widehat{k}$ defined above and $k^{\circ} \equiv \Delta\pi_H/\eta$. The latter function gives us a threshold of k above which this parameter must be for the insiders' evidence-production decision under HE to have an interior solution (i.e., for $\tau_H^{HE} < 1$).

Before we proceed to discuss the intuition for why we obtain the various rankings in different parts of the parameter space, let us make the observation that the institution HE, which is the only one of the three institutions that involves an efficiency defense, is indeed sometimes the best one. Hence, Propositions 1 and 2 tell us that an efficiency defense *is* sometimes desirable. If so, however, *the burden of proof should be placed fully on the insiders.* The logic behind this conclusion is that an institution where the burden of proof is placed fully on the insiders will give them strong incentives for evidence production [cf. (3) and the discussion following that equation]. Moreover, encouraging evidence production will under certain circumstances be socially desirable.

It is interesting to note that the argument that the burden of proof as to efficiencies should rest on the insiders has been made before in the literature, although the logic leading up to this conclusion has been quite different from the one here. For example, Fisher (1987, p. 36) writes: "The burden of proof as to cost savings or other offsetting efficiencies [...] should rest squarely on the proponents of a merger, and here I would require a very high standard. Such claims are easily made and, I think, often too easily believed." It seems clear that in making this statement Fisher is concerned about the truthfulness of the insiders' claims, and he thinks of placing the burden of proof on them as a way of controlling this problem. A very similar point is made by Neven et al. (1993, p. 206): "When the burden of proof is on the firm, the knowledge that information that it conceals may count against it in the investigation provides a powerful incentive in favour of revelation." This argument goes back to the so-called unraveling result in the disclosure literature, which is due to Grossman (1981) and Milgrom (1981). The argument of the present paper is very different from—and should be thought of as complementary to—the unraveling result. Indeed, updating of beliefs is not an issue here, because of our commitment assumption. Our analysis instead suggests that placing the burden of proof on the insiders may, besides encouraging information revelation, also serve another important purpose, namely to provide them with strong incentives for socially valuable evidence production (or information acquisition).[18]

Next, let us consider the condition HE $\succ$ SR if and only if $\eta > \Delta\pi_H/\Delta W_H$, which we derived above and which plays a particularly important role in Panel A of Figure 2. If there are positive externalities (i.e., if $\Delta W_H > \Delta\pi_H$), then this condition says that we always have HE $\succ$ SR, since $\eta > 1$.[19] This is intuitive,

[18] It should be emphasized that this result concerns the *burden* of proof, i.e., the question who is to prove the existence of efficiencies. Another interesting question concerns the optimal *standard* of proof: how convincing should one should require a given piece of evidence to be and what should be the minimal level of efficiency that must be proven? In our model we have abstracted from these questions since, by assumption, a piece of information either reveals the true state perfectly or not at all and our state space is binary. In a richer model, in which one or both of those assumptions were relaxed, we would be able to derive also the optimal standard of proof. If we did that, however, we would not generally expect the highest possible standard to be optimal. For requiring a very high standard of proof would not necessarily create the strongest possible incentives for evidence production. To see this, imagine an example were there are more than two states and where the insiders can get their case through only by finding evidence in favor of the very highest state. This might be so difficult and costly to do that investing in evidence production would not be as worthwhile as under a less stringent standard-of-proof requirement.

[19] Notice that both Panel A and B are drawn for the case where there are negative exter-

because if having a high-efficiency merger permitted instead of banned is worth more to society than to the insiders then the merging firms will underinvest, so society should encourage evidence production as much as it can. Recall from Section 2 that having positive externalities means that a "high" post-merger efficiency is so high that it would make consumer surplus increase. Hence, a sufficient condition for HE to dominate SR (and, in Regime I, for HE to be the best institution) is that, conditional on the event that the merger makes total surplus increase, the efficiency gains are indeed so large that they are passed on to consumers in the form of a lower price. The reason why we obtain this result is *not* that we are using a welfare measure that only takes into account changes in consumer surplus—our welfare measure does indeed consider *total* surplus.[20] Rather, the reason is that when "high" efficiencies are so high that they induce a lower post-merger price, then the relationship between society's and the insiders' interests is such that an efficiency defense will never give rise to overinvestment in evidence production and, hence, investment in evidence production should be fully encouraged.

If there are negative externalities, then HE will dominate SR only if the cost elasticity is large enough. Why does the cost elasticity play such an important role here? One—perhaps rather mechanical—way of seeing this is by noticing that for large elasticities the cost $C(\tau_H)$ is low relative to the amount of information that one gets for these expenditures, τ_H,[21] which clearly makes HE more attractive. Another way of understanding the role of the cost elasticity, which is more in terms of economics, is to make the following observation: in equilibrium, the cost elasticity equals the insiders' "surplus from evidence production"; that is, if we let $B\left(\tau_H^{HE}\right)$ denote the insiders' gross benefit from having HE instead of SR conditional on knowing that $e = e_H$,[22] then we can

nalities.

[20] Compare the following statement by Fisher (1987, p. 38), who clearly has a consumer standard in mind: "...I would hesitate to use such efficiencies as an excuse for permitting a merger if those efficiencies are unlikely to be passed on to consumers."

[21] This is a property of the cost function $C(\tau_H) = k\tau_H^{\eta}$. To see this, the reader may find it helpful to sketch the graph of $C(\tau_H)$ as a function of τ_H for different η's. For η's close to unity the graph is almost linear whereas for larger η's it is more curved, which makes it possible to have relatively large τ_H's and at the same time low levels of $C(\tau_H)$.

[22] Formally, $B\left(\tau_H^{HE}\right) \equiv E\left(\pi^{HE} \mid e = e_H\right) - E\pi^{SR} = \left(\tau_H^{HE}\Delta\pi_H + \pi_N\right) - \pi_N = \tau_H^{HE}\Delta\pi_H$.

write[23]

$$\eta = \frac{B\left(\tau_H^{HE}\right)}{C\left(\tau_H^{HE}\right)}. \tag{9}$$

Hence, the larger is η, the more do the insiders' benefits of having HE rather than SR exceed their costs. As a result, for large enough η's, HE will be socially desirable also when there are negative externalities.

Now let us move our attention from Panel A to Panel B. Here, for HE to be the best institution, it does not suffice that $\eta > \Delta\pi_H/\Delta W_H$. As the figure indicates, the requirement on η is stronger than that. Moreover, the other parameter in the cost function, k, must not be too large. Apparently, there is an asymmetry between a situation where society is sceptic about the possibility of large efficiency gains (Regime I) and one where it is more optimistic (Regime II): in the latter case HE (and, hence, an efficiency defense) is less likely to be optimal. The basic reason for this asymmetry is that the insiders have a vested interest in having the merger permitted, regardless of whether the efficiency gains are small or large. Moreover, in Regime I this vested interest will be easier to deal with for society than in Regime II. For, in Regime I, if not having received a report it will be optimal for society to ban the merger, whereas in Regime II it may in that case be optimal to permit the merger. This means that in Regime I society will need to know about a high state, something it can obtain information about with a relatively large likelihood by choosing the institution HE. In Regime II, however, society would like to know about a *low* state, which they *never* will get information about from the insiders.

The asymmetry between Regime I and II is neatly illustrated by considering the limits $p \to 0$ and $p \to 1$. In the former case we still have the condition that HE is best if and only if $\eta > \frac{\Delta\pi_H}{\Delta W_H}$, since that condition is independent of p. In the latter case, however, LF is *always* the best institution.

Proposition 3 sums up the results.

Proposition 3. *The institution that maximizes expected welfare is:*

- *In Regime I: SR if* $\eta < \frac{\Delta\pi_H}{\Delta W_H}$ *and HE if* $\eta > \frac{\Delta\pi_H}{\Delta W_H}$.

[23] To see this, note that, by definition, $\eta = \tau_H C'\left(\tau_H\right)/C\left(\tau_H\right)$. Moreover, from the first-order condition that defines τ_H^{HE}, we have $\tau_H^{HE} C'\left(\tau_H^{HE}\right) = B\left(\tau_H^{HE}\right)$.

- *In Regime II: LF if* $\eta < \frac{\Delta \pi_H}{\Delta W_H}$, *or* $\eta > \frac{\Delta \pi_H}{\Delta W_H}$ *and* $k > \widehat{k}$; *and HE if* $\eta > \frac{\Delta \pi_H}{\Delta W_H}$ *and* $k < \widehat{k}$.

The bottom line message of Proposition 3 and the preceding analysis can be stated as follows. By allowing for an efficiency defense society also encourages costly evidence production (or information acquisition). Doing this may be good or bad, depending on (i) how society's and the insiders' interests relate to each other, (ii) how optimistic or pessimistic society is about the likelihood that the merger will increase total surplus, and (iii) the technology for evidence production (in particular the cost elasticity). An efficiency defense will indeed be optimal under some circumstances—but, if so, the burden of proof should be placed fully on the insiders. Moreover, an efficiency defense is more likely to be optimal (from a total surplus point of view) when "high" efficiencies are so high that they would give rise to a lower market price. This is because then the insiders' incentives to invest are such that society should encourage evidence production as much as it can. Finally, there is an important asymmetry between a situation where society is pessimistic and where it is optimistic about the possibility that total surplus will increase due to the merger: an efficiency defense is more likely to be harmful in the latter case.

5 Implications for Antitrust Policy

Our results are, of course, derived from a stylized model, and by studying our particular set-up we have abstracted from many economic phenomena that are important for the choice of a merger control institution but which are not captured here. Still, keeping these limitations in mind, it is useful to spell out what our results imply for antitrust policy and the design of merger control institutions.

Let us first be more specific about how we interpret the institutions LF and SR of our model. We think of these as representing situations where society (or an antitrust authority) has made a commitment not to take *efficiency considerations* into account when deciding whether to permit the merger. Still, these institutions are fully consistent with a merger control procedure in which this decision is contingent on other circumstances, as long as information about these is publicly available. Thus, what we believe is special with efficiency gains is that this is something that the insiders are likely to have (or be able to obtain) private information about.

Another important question is how one should understand the insiders' "influence activities." One interpretation, which is the one we emphasize here, is that this term refers to the insiders' communication with an antitrust authority in a formal regulatory hearing. Another and broader interpretation would be that the influence activities also take place in informal (and perhaps secret) interactions between the insiders and officials from the antitrust authority. As long as we are willing to make the former interpretation, it seems reasonable that the decision whether to allow for an efficiency defense does not have to be made once and for all, but could be made contingent on information about a particular merger case. If so, then we can make use of the results and insights from the previous section in order to design a merger control procedure that allows for an efficiency defense only when the circumstances are right.

Below we sketch such a procedure. This involves three steps, and it is constructed by means of simply inspecting Panel A and B of Figure 2: first it is determined which panel is the relevant; then it is decided where in a particular panel we are likely to be. Our procedure presupposes that the region in Panel B where HE is optimal is irrelevant in practice. This is always true if society, whenever it is "optimistic" about having high efficiency gains, indeed is sufficiently optimistic (i.e., that p is large enough). If one believes that the HE-region of Panel B *is* sometimes relevant, then the procedure below will be a bit more complex.

Step 1. An antitrust authority that is faced with a proposed merger asks itself the following. Given the information that we have access to at this stage of the procedure (i.e., prior to any reports from the insiders about the size of the efficiencies), do we think that overall welfare (i.e., total surplus gross of any costs of evidence production) will rise thanks to the merger? If the answer to this question is yes, then the antitrust authority simply permits the merger. If the answer is no, then the antitrust authority proceeds to Step 2.

Step 2. The antitrust authority asks itself the following. Suppose, hypothetically, that we knew that the welfare gains due to the merger (gross of any costs of evidence production) indeed would be positive. Then, conditional on that information, do we think the efficiencies are so high that they would be passed on to consumers (i.e., induce a lower post-merger price)? If the answer to this question is yes, then the antitrust authority asks the insiders to provide it with evidence about the size of the efficiencies. In case the insiders do come up with convincing evidence that the efficiencies are large enough to raise welfare (i.e., total surplus gross of any costs of evidence production), then the antitrust authority permits the merger; otherwise it does not. If the answer to the question is no, then the antitrust authority proceeds to Step 3.

Step 3. The antitrust authority asks itself the following. Suppose, hypothetically, that we knew that the welfare gains due to the merger (gross of any costs of evidence production) indeed would be positive. Then, conditional on that information, do we think that the insiders' technology for evidence production (or information gathering) is such that the cost elasticity is large relative to the rise in market price due to the merger? If the answer to this question is yes, then the antitrust authority asks the insiders to provide it with evidence about the size of the efficiencies. In case the insiders do come up with convincing evidence that the efficiencies are high enough to raise welfare (i.e., total surplus gross of costs of evidence production), the antitrust authority permits the merger; otherwise it does not. If the answer to the question is no, then the antitrust authority blocks the merger without asking for evidence.

A couple of remarks about this three-step procedure are in order. First, even though it may look as if the procedure does not consider other important criteria than the possible existence of efficiency gains, these are indeed captured by Step 1. For when the antitrust authority makes an assessment of the likelihood that total surplus will increase thanks to the merger, it effectively also appraises, for example, the merger's impact on the degree of concentration in the relevant market. Second, if the antitrust authority has to proceed to Step 3, then information about the cost elasticity will be needed. The magnitude of this elasticity may of course be hard to observe in reality. Still, as our procedure indicates, in several cases it will be possible to tell whether or not an efficiency defense is desirable without knowing the elasticity. Inevitably, though, sometimes knowledge about the cost elasticity will be needed. Hopefully, in those cases the interpretation of the elasticity as the "surplus from evidence production," which we provided earlier [see (9)], will be helpful in making informed guesses about its magnitude (or even, after all, estimate it using some observable data).

6 Possible Extensions

In this concluding section we will briefly discuss some possible extensions and variations of our model.

Evidence production vs. information gathering. In our model we have assumed that the insiders know from the outset whether the efficiencies are high or low but must invest resources in order to be able to communicate this information. An alternative assumption would be to say that the insiders at the outset have just as little information about the efficiencies as society, but that they can invest resources in order to find such (hard) information. Hence, the insiders' investment decision would then not be contingent on the true state. We were using this model specification in an earlier version of the paper, and it yields very similar results. In fact, most of the analysis is *identical* to the one here—the only difference is the comparison between HE and LF (in particular, the cut-off value $\widehat{k}$ is slightly differently defined), and even for that comparison the qualitative results remain the same.

A consumer standard instead of a welfare standard. Throughout we have assumed that society maximizes total surplus (net of any costs of evidence production). How would the analysis change if we instead assumed a consumer standard? To see this, first notice that if only consumer welfare counts, the costs of evidence production will not enter the social welfare function. Moreover, Figure 1 tells us what the benefits for the consumers of permitting a merger (i.e., ΔCS in the figure) are. We see that as long as there are negative externalities, society will always want to ban the merger (thus making SR optimal). If there are positive externalities, then the incentive structure will be similar to what we have under our welfare standard. Since evidence production is "for free," it is fairly easy to see that here SR is always inferior to HE. Moreover, a "mixed" z-institution will never be optimal. The optimal institution is thus either HE or LF. One can show that there is a cut-off value of p such that below this HE is optimal and above it LF is optimal.[24]

Other parties' trying to influence the merger control procedure. We have assumed that only the insiders can provide society with information and thereby try to influence the decision whether to permit the merger. We think of this as the most natural case, since the insiders should have better access to information about any efficiencies than, for example, the other firms in the market (i.e., the outsiders). Still, one may wonder how the results would be affected if also the outsiders or the consumers could produce evidence. Again, Figure 1 helps us understand the incentives of these other groups. First suppose we have positive externalities (we assume again, as in our main model, a welfare standard). Then we see from the figure that the outsiders' interests are always opposed to society's; hence, the outsiders would not be able to credibly transmit any information. We also see that the consumers' and society's interests are identical; thus, any information that the consumers had access to would also be available to society, which would at least mitigate the informational asymmetries between society and the insiders.

Second, suppose we have negative externalities. Then Figure 1 tells us that the outsiders and the insiders have identical interests. This means that society can receive information from two parties instead of only one, which could make it less attractive to encourage maximal evidence production through HE. On the other hand, there should also be a free-riding problem, and the convex cost

[24] We can write $ECS^{SR} = CS_N$, $ECS^{LF} = pCS_H + (1-p)\,CS_L$, and $ECS^{HE} = p\tau_H^{HE}\Delta CS_H + CS_N$ (where the notation is self-explanatory). As in the total-welfare-standard model, we can without excluding any optimal institution presume that $z_L \leq z_N \leq z_H$. Hence, analogously to (5), we can write

$$ECS = p\tau_H^*\,(z_H - z_N)\,\Delta CS_H + (1 - z_N)\,ECS^{SR} + z_N ECS^{LF}.$$

An institution where $(z_H - z_N) \in (0,1)$ cannot be optimal. To see this, suppose that we do have $(z_H - z_N) \in (0,1)$ in an optimal institution. Then we can write

$$ECS < p\tau_H^{HE}\,(1 - z_N)\,\Delta CS_H + (1 - z_N)\,ECS^{SR} + z_N ECS^{LF} = (1 - z_N)\,ECS^{HE} + z_N ECS^{LF},$$

which contradicts the assumption that the institution is optimal. Hence, either HE or LF is optimal (notice that this result holds without any particular assumptions about the cost elasticity). Straightforward algebra shows that the cut-off value of p above which LF is best is given by

$$p = \frac{-\Delta CS_L}{(1 - \tau_H^{HE})\,\Delta CS_H - \Delta CS_L}.$$

functions may make evidence production more worthwhile when it is spread out on two parties. It is thus not clear whether this alternative model would make an efficiency defense more or less desirable and whether, as before, the answer would depend only on the magnitude of the cost elasticities.[25] Finally, with negative externalities the consumers will always be against the merger. Also here is it rather difficult to know how the results would change: there should be different effects working in opposite directions. We leave this and the other open questions to future research.

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[25] Such a model would also make the z-institutions more complex, since the decision whether to permit a merger could be made contingent on, for example, whether only one of the interested parties have submitted a particular report or whether both have done this.

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Figure 1: Gains and losses for different parties due to the merger.

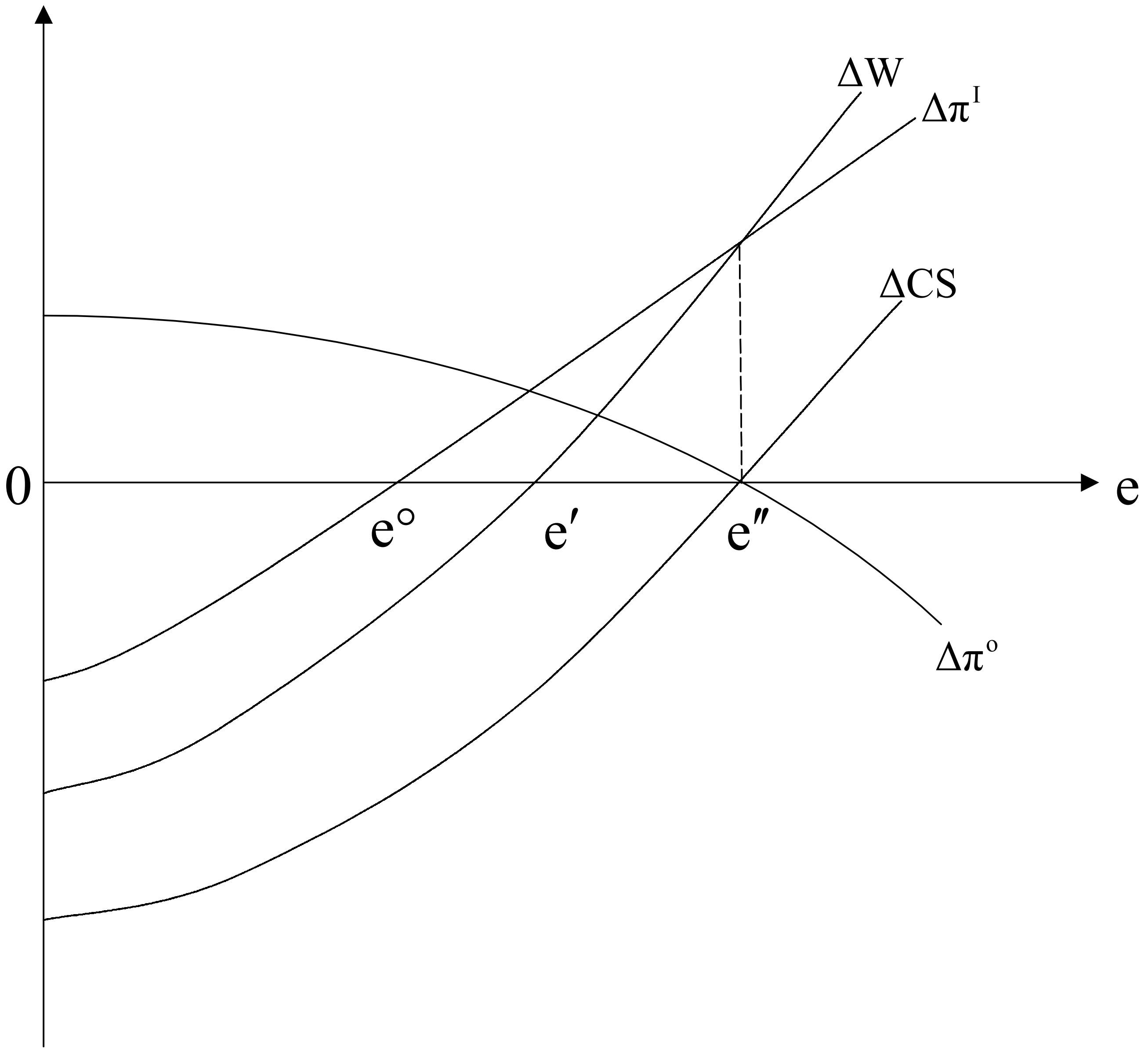


Figure 2: Panel A. Welfare comparison of institutions for Regime I.

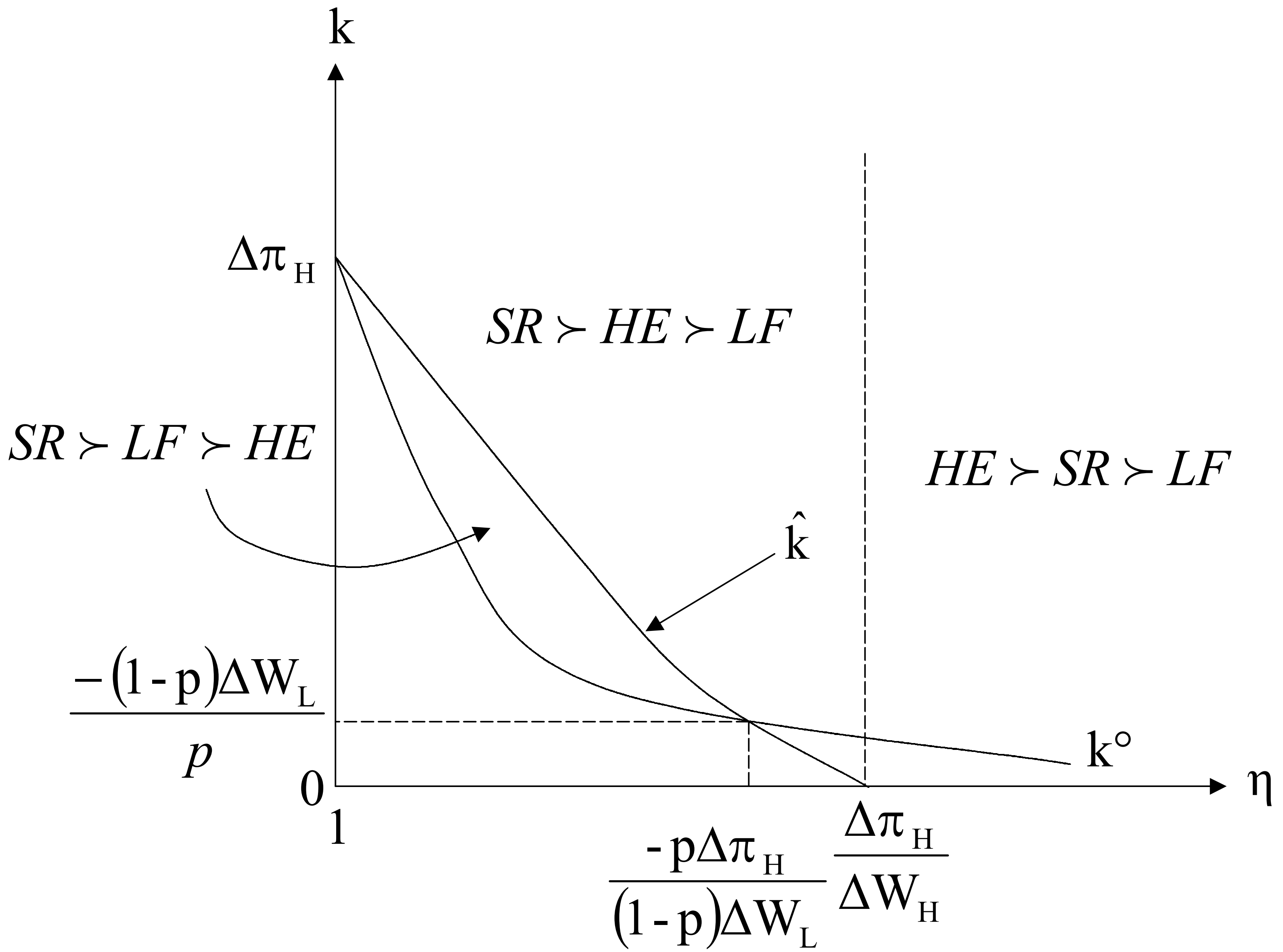
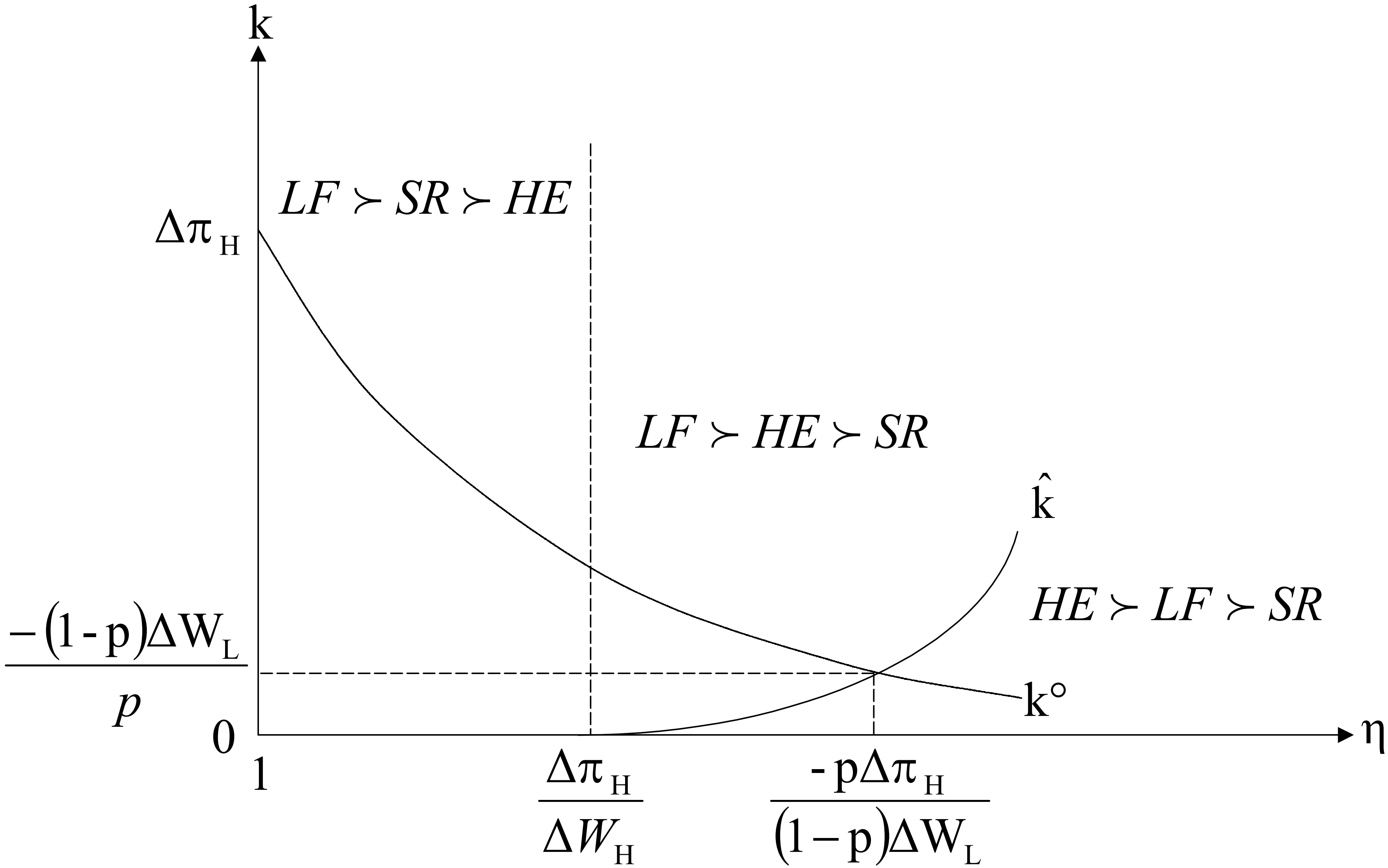


Figure 2: Panel B. Welfare comparison of institutions for Regime II.



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